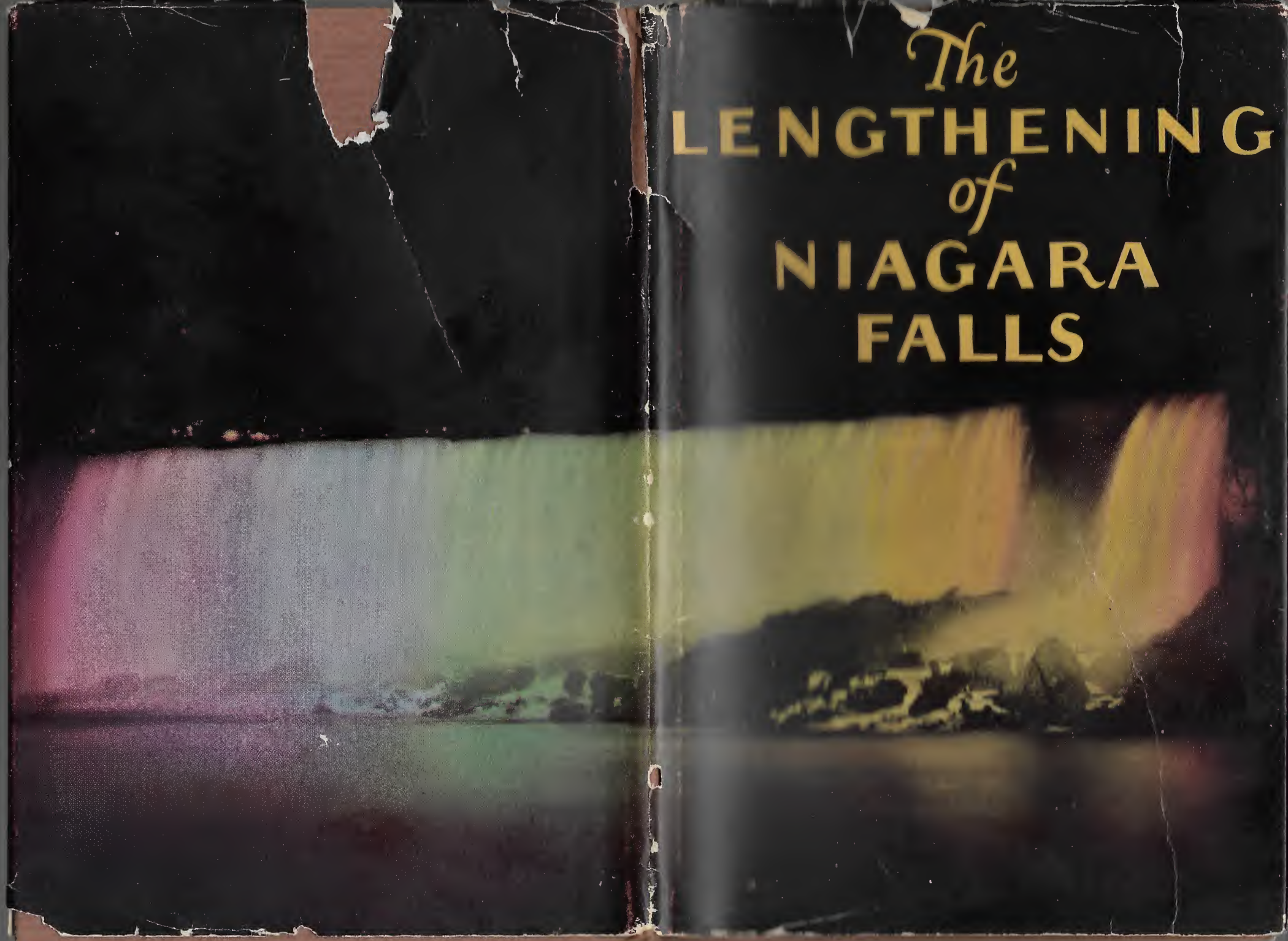
The LENGTHENING of NIAGARA FALLS



THE LENGTHENING OF NIAGARA FALLS

COMPANIES ASSOCIATED WITH
BUFFALO, NIAGARA AND EASTERN POWER CORPORATION

THE NIAGARA FALLS POWER COMPANY
BUFFALO GENERAL ELECTRIC COMPANY
NIAGARA, LOCKPORT AND ONTARIO POWER COMPANY
NIAGARA ELECTRIC SERVICE CORPORATION
TONAWANDA POWER COMPANY
WESTERN NEW YORK UTILITIES COMPANY, INC.

SIX MILLION WILD HORSES

The wild waters of Niagara have a potential energy of about six million horsepower.

PART I

LENGTHENING THE SCENIC SERVICE OF NIAGARA FALLS

ABRAHAM LINCOLN said: "Niagara calls up the indefinite past. When Columbus sought this continent—when Christ suffered on the Cross—when Moses led Israel through the Red Sea—nay, even when Adam first came from the hand of his Maker; then, as now, Niagara was roaring here."

In the few score years since Lincoln lived, the Horseshoe Falls have eaten their way backward a distance of over 350 feet.

No man knows what great spasm of Nature created Niagara. Science tells us its birth took place 30,000 years ago, and that the cataract must have been then 8 miles below its present site.

The first white man to view Niagara was a fearless French missionary, Father Hennepin. If you had stood with him you would have seen the cataract stretching from shore to shore in an almost straight line. The deep inward sweep of the present Horseshoe curve was unborn.

A century later, the first survey of the Falls was made by British engineers. Their charts show that in 1764 the deep crescent of the present Horseshoe had hardly begun.

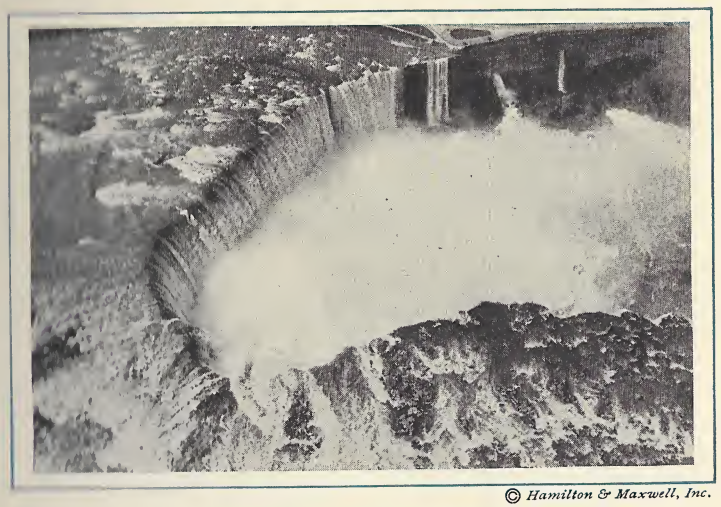
Standing today on the Falls View Bridge or on the Canadian bank, you can view with one glance the full sweep of both the American and Horseshoe Falls. The 3000-foot-wide curve of the Horseshoe is still fairly visible. But if the throat of that curve retreats many feet deeper, much of the Horseshoe's beauty will be lost.

Why is the Horseshoe eating itself to ruin?

Why is it hiding its beauty behind an ever greater veil of spray?

Why are its wings becoming barer?

The casual observer would answer "not enough water," but curiously enough the answer is startlingly different.



Aerial photography reveals how the Horseshoe is eating itself away.

The Great Lakes above the Falls form a never-failing reservoir. Niagara takes the spillover from a basin 250,000 miles in area—50% larger than all of France. Over 60% of this basin lies within the United States.

Without the addition of another raindrop—if it were possible to drain out the water now stored behind Niagara Falls—there would be enough to run the Falls at their present rate for over 100 years.

Niagara has been called the "spout" of this basin. It is not the spout—it is the lip—it takes only the water that overflows.

NOT TOO LITTLE WATER BUT TOO MUCH

Niagara's vulnerable spot is in the throat of the Horseshoe Falls. Each year, the force of the torrent eats away six feet of rock at this point. Old pictures of the Falls reveal the march of this erosion during the time the white man has known Niagara. On the opposite page, a chart shows the outlines of the Falls as they appeared in 1764—1842—1875—1906—1925—and as they are today.

At the Horseshoe's throat where this backward march is fastest, the water is about 15 feet deep—twelve times greater than the depth at the crest of the American Falls. And yet the American Falls

THE RETREAT OF THE HORSESHOE'S CREST
Government surveys show the recession marked by the lines from 1764 to 1925.

are fully as majestic. Moreover, they are free from the bare spots that mar the Horseshoe.

Thus, if the throat of the Horseshoe were one-tenth as deep as now, the backward march would be retarded. With a more moderate flow of water, the Horseshoe's grace would no longer be concealed behind a too-thick wall of mist. Instead, it would be shrouded with a veil of spray so dainty that it would enhance the cataract's splendor.

Man can moderate this excessive flow. To do this, there are two plans which have been long discussed:

1. A series of under-water dams or weirs to be built in the rapids above the Horseshoe.

2. A series of artificial islands to be scattered scientifically through the main channel.

As to which of these two plans is the better, science need no longer debate. Demonstration can now take the place of discussion. By laboratory methods, the results can be compared in advance of the actual construction. The test-tube by which the answer can be scientifically determined is pictured on the opposite page. At first glance you may think this is the great cataract itself. You look again—and discover that it is a perfect Niagara Falls, but one just large enough for Lilliputians such as Gulliver found in his travels.

MORE THAN A TOY

This tiny Falls is more than a toy. It is a scientific model—the largest ever built. It is ever at the disposal of government commissions, or representatives of civic or engineering institutions who may desire to make experiments to determine just how the problem of the Falls can best be solved.

Engineers of the Buffalo, Niagara & Eastern Power Corporation who have lived with the Falls, and have learned to love them, made the model. Chief among these scientists was John Lyell Harper. Before he died in 1924 he said:

A perfect miniature of Niagara—
used for experimental purposes.

JOHN LYELL HARPER, 1873-1924

"Positive action, taken with courage, intelligence, and as soon as possible, is necessary so that the greatest scenic spectacle of the United States shall not commit suicide."

The American, or lesser Falls, carries only slightly more than 6% of the total discharge from Niagara River. The fact that the American Falls represents at least 25% of the total scenic spectacle, again proves that the beauty of the cataract is not dependent on mere volume of water.

The model demonstrates how proper distribution of a controlled volume of water can lengthen the life of the Falls' present beauty. It shows beyond a doubt that only 35% of the outflow of the river is needed on the Horseshoe Falls to produce an even *greater* scenic effect than the present one.

At the model you can see how this reduced volume of water could be more uniformly distributed over the whole Horseshoe. You can see how the present dry spots on the sides of the Horseshoe would then be covered with tumbling water, and the forces which now tend to destroy the beauty of the Falls would cease to be a menace.

This view of the model shows how artificial islands and under-water dam could spread the water evenly along the whole crest of the Horseshoe Falls.

There is a splendid precedent for this effort of man to lengthen the life of Niagara's beauty. Nowhere have man and nature worked together better than in the illumination of the Falls at night. It was in 1925 that a battery of 24 arc lamps, each 36 inches in diameter, was installed. Their 1,320,000,000 candlepower has lengthened the day of the Falls' beauty so that it now extends far into the evening.

WHAT A TORRENT!

With a straight drop of 165 feet to the gorge below—a width at the crest of 4000 feet—a water flow of about 70 million gallons per minute—Niagara is admittedly the greatest fall of water in the world.

Goat Island, about 1300 feet in width, divides the water at the very edge of the Falls. On the American side runs a channel 1000 feet in width, over which falls about 6% of the total flow. On the Canadian side the channel spreads to a width of 3000 feet, and here 94% of the stream hurtles over the Horseshoe Falls.

From the Falls the waters race their way down through the Gorge into the Whirlpool, and thence through widening channel into Lake Ontario, ten miles below.

All in all, the Niagara River falls 336 feet between Lakes Erie and Ontario. Within a distance of a mile there is a quick drop of 220 feet through the upper rapids and over the cataract. A further drop of 94 feet through the lower rapids makes a total drop of 314 feet in five miles.

Thus there is more to Niagara Falls than the Falls itself. The torrent below the Falls, and the Whirlpool alone, with its 64 acres of fascinating mystery—both would be worth a trip across the continent to see, even if there were no Cataract.

The greatest and most beautiful fall of water in the world.

The majestic beauty of these waters tumbling down the gorge could be enjoyed by the Indians—for they could clamber down the precipices. But, most of this grandeur would be denied to us of today, if it had not been that man again—on his private initiative—had had the courage to construct an electric railway through the gorge at the water's edge.

So again the splendor of Niagara Falls was lengthened by the Niagara Gorge Railroad—"The Falls and Whirlpool Rapids Route."

Perhaps the day will come when by a wise conservation of the water, science will check the hastening suicide of the Horseshoe, and lengthen its beauty into the far future.

From the Falls the waters race down through this Gorge into the great Whirlpool.

PART II

LENGTHENING THE ECONOMIC SERVICE OF NIAGARA FALLS

Flying high above the Canadian shore, [illegible] the full sweep of Niagara's grandeur.

Chabert Joncaire rolled up his sleeves one fine summer's day and started to dig a ditch. Chabert's spade was a queer-looking, old-fashioned implement, but it started a mighty job.

This happened in 1757. Joncaire was a French fur trader who had settled on the Niagara River bank, near the Falls. Joncaire wanted furs. Up the lakes there were Indians who had furs to trade. If Chabert had boats he could travel far for his furs—fill up the boat and profit handsomely.

But boats required lumber for their building. And lumber needed a sawmill. That is why Chabert Joncaire dug a ditch on a summer's day in 1757. The ditch, a semicircular affair, led water out of the swift-flowing river, and turned it back again just above the cataract. Straddling Joncaire's ditch was his primitive sawmill—the first industry to use the power of Niagara.

The hum of Joncaire's sawmill may not have been heard around the world, but its echo hums today in hundreds of cities, towns, and hamlets where Niagara Power Service helps light the homes and lightens the burdens of millions of men and women.

NIAGARA—THE SERVANT

Niagara today is the faithful servant of a considerable portion of the United States. It furnishes electricity to a populous area of some 25,000 square miles.

In hundreds of thousands of homes, Niagara Power Service now cleans the rugs, cools the food, cooks the meals, washes the clothes and does countless household chores.

In thousands of factories, Niagara Power Service now runs the machines that produce necessities to supply half a continent.

Rubble-stone construction makes the world's greatest hydro-electric power house seem part of the cliff itself.

And what a mountain-range of coal it saves! The same electricity that Niagara provides could not be produced by steam except with an amount of coal that would average several tons per year for every home served!

For nearly a hundred years after 1757 there was no essential change from Chabert Joncaire's primitive methods.

Niagara thundered on, but there was no one to understand its roar.

Then in 1852 came a new vision.

A group of men dug what is called the Hydraulic Canal.

This canal was part of a project to take water from a point about a half mile above the American Falls to the cliff wall of the gorge below the Falls—not to make electricity but to run a millstone. At that time, electricity had been applied to telegraphy, but otherwise its uses were undreamed.

Started in 1852, the Hydraulic Canal produced nothing but financial disasters for the next 25 years.

Walter Bryant and his associates struggled against unexpected obstacles, sank a great fortune in the project, and had to give up.

Then Horace H. Day and his associates took up the task and spent twice as much again, before they, too, confessed failure.

In 1877 when Jacob F. Schoellkopf and his associates bought the canal property, the only use made of the canal was to operate a small grist mill. Nearly everyone believed that this purchase was sure to result in another disaster. No one else was willing to accept so great a financial risk. No one envied him in his "reckless" courage.

Electricity as we know it today was still unknown.

Power could only be transmitted direct from the water to the machinery used. Yet these pioneers persisted. Eventually, they had a flour mill using 900 horsepower on the shores of their canal.

Then came electricity, and the knowledge that the power of the falling waters of Niagara could be transmuted into the new miracle.

In 1879—27 years after the Hydraulic Canal was begun—Prospect Park in Niagara Falls was lighted by electric lights. The railroads ran excursions so crowds could see the marvel. In 1881

water wheels of 2000 horsepower capacity were connected with dynamos by a rope drive, and the electric power developed was sold for lighting purposes.

At last the wild horses of Niagara Falls had been truly tamed and put to work. The power service of the Falls had been lengthened from that of a water wheel to that of a dynamo, manifolding the force of the current for the service of mankind.

Many obstacles remained. But bit by bit, additional capital was obtained for the necessary experimental work. Little by little, the power plant was extended.

And so Niagara began to serve the world in material ways.

The lengthening of Niagara's economic service to mankind has taken two directions:

1. Indirectly, through the many electro-chemical products which are being manufactured at or near Niagara by Niagara Power and bestowed upon mankind throughout the world.

2. Directly, through the cheap dependable power, distributed to the homes and factories of a populace of more than 2,000,000.

The indirect service came first. In the early nineties, there were men of science here and there all over the country, desperately endeavoring to develop nature through electricity. At Niagara another set of men were at the same time desperately endeavoring to develop electricity through nature. The chemists came to Niagara and founded industries. Their products revolutionized the world's industrial processes.

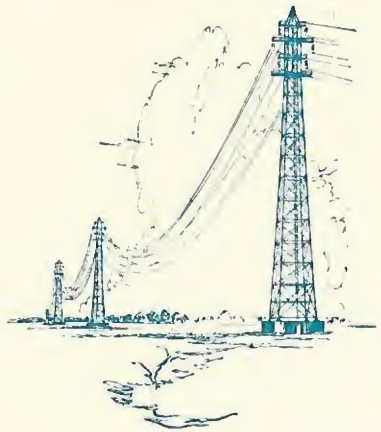
For instance, diamond dust was one of nature's gifts. In 1894, the Carborundum Company started to make a substitute for it. At first, this sold for $140 a pound. Because of cheap Niagara Power, it is now an inexpensive abrasive. Without carborundum and other artificial abrasives the cost of polishing and grinding metals would be far greater than it is today.

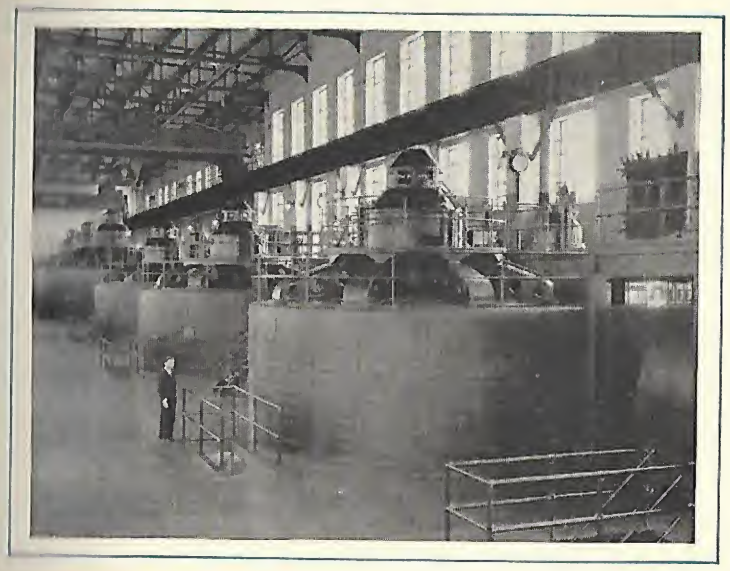
Aluminum is another product of genius plus cheap Niagara Power. The first globules of metallic aluminum were produced electrolytically in 1886.

Aluminum did not become of general use until 1895, when the first aluminum plant was started at Niagara. Since then, aluminum has become the indispensable light metal of commerce.

Likewise, Niagara Power has given to the world most of its ferro-alloys—the silicon, chromium, tungsten, molybdenum, carbon-titanium that have so vastly improved the quality of iron and steel as well as artificial graphite, magnesium, sodium, potassium, chlorine and a hundred other electro-chemical products.

Niagara Power made these industries possible—but still Niagara Power itself was available only within sound of the cataract's roar. The industries it served clustered close to the river. Even so famous an engineer as George Westinghouse had little hope that power could be carried at any distance. He suggested that Buffalo—20 miles away—could be served by Niagara, not with electricity, but with compressed air produced electrically at Niagara and piped to Buffalo—another way was finally found.





The first three generators are each of 37,500 horsepower—the three in the background are of 70,000 horsepower each.

When the transmission of electricity did develop, a furious battle raged as to whether direct current or alternating current was the better. Thomas A. Edison favored direct. So did Lord Kelvin, England's most famous physicist. True, direct current could not be transmitted except at a wastage of 30% to 40% enroute. And yet, expert opinion of that day was so strong for direct current that 95% of all electricity was direct and only 5% alternating.

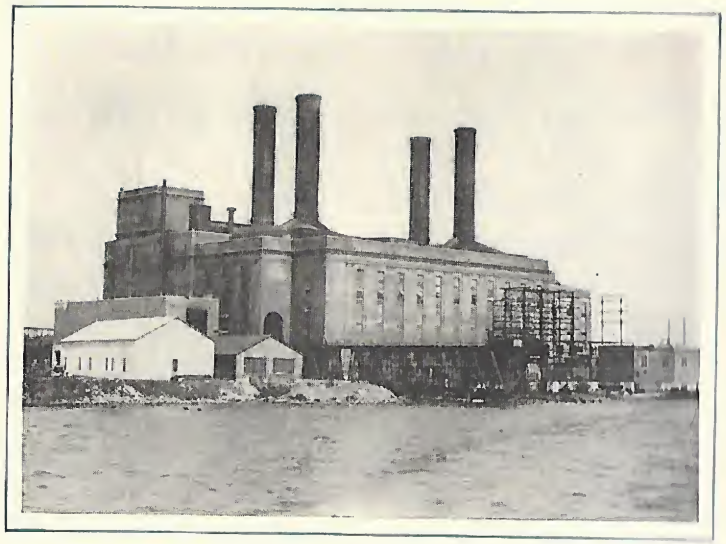
Lord Kelvin later swung over to the advocates of alternating. Subsequently, the power pioneers at

Niagara adopted alternating current for their first lines to Buffalo. They proved that the loss from transmission was small compared to direct current. Since then the tables have turned. Today, 96% of all current is alternating and only 4% direct.

By 1900, many power lines radiated from Niagara Falls, but not until 1905 was the Niagara Power Service lengthened to the great distances of today.

In that year, it was proposed to extend power lines to Syracuse, 200 miles away.

Onlookers thought the project impractical. "No money for such foolishness," said the bankers.



The C. R. Huntley steam station, located at Buffalo, N. Y., making available 200,000 horsepower for Niagara Power Service.

But the lines went through.

And Syracuse today uses twenty-five times as much electric power as it did in 1907.

MAKING WATER WORK

The Niagara Power Service long-distance transmission lines are now insulated for 110,000 volts. With this voltage, the system has a capacity to transmit 500,000 horsepower—much more than is now available.

From the beginning, this transmission system has grown apace with progress in electrical engineering. The company today has in operation more than 1300 miles of high-voltage circuits. This vast system covers 17 counties in New York State, reaching 2,000,000 people in more than 500 cities, towns, villages and lighting districts.

From Erie, Pennsylvania, to Syracuse, New York, some 2,000,000 people now daily enjoy Niagara Power Service. A service, as unvarying as the age-long rush of Niagara's torrents, flows over wide countrysides to lighten man's labor in the factory and to bring cheer and comfort to the home.

With maximum engineering efficiency, Niagara Power Service now uses every cubic foot of water that can legally be diverted from above the Falls on the New York State side. From this, a maximum

of 480,000 horsepower is produced. Additional power can now be obtained only by governmental permission to divert more water.

The Buffalo, Niagara and Eastern System also includes other hydro-electric stations located in Northern and Western New York. To supplement these, the company also has large steam generating stations. All of these plants are interconnected with Niagara Falls and with each other. Thus, coal is used only when the demand is too great for the water power. And all day long, and all night long, current is dispatched from where it is least needed to where it is most needed.

Thus Niagara Power Service is more than lengthened. It is insured, because its sources are several. And it is made economical, because the supply and demand are kept continually leveled.

In addition to initiative, this great system has required tremendous investment. But the result is worth while, maximum power at minimum cost.

In fact, the cost is so low that the electricity furnished by Niagara Power Service is the biggest bargain the consumer buys. For while the price of many necessities of life, such as food and clothing, have advanced nearly 100% since 1915—the cost of electricity has actually *decreased* during the same period.

WHAT OF THE FUTURE?

The demands of home and farm and industry for Niagara Power greatly exceed the supply. As the coal resources grow less, and the demand for electricity grows greater, this shortage will be ever more acute.

Obviously, it is to the public's advantage that more power be produced from Niagara Falls. But the problem is complicated by international relations. The boundary line between the United States and Canada runs through the Niagara River. The amount of water that may be diverted from above the Falls is limited by treaty.

The first interest of the great majority of American people is, and always should be, to lengthen the life of Niagara's beauty.

And yet, the same projects that would insure the beauty of the Falls could also serve to lengthen the arm of Niagara's economic service to mankind.

A more intelligent distribution of the water along the Horseshoe Falls would do more than make the cataract more beautiful—it would make it possible to utilize a larger volume of water for power purposes the year round.

Whatever is best for the public interest is best for the Buffalo, Niagara and Eastern System. Its

success has come solely from its service to its public. In fact, it is largely owned by the public it serves. Over 20,000 of its consumers are numbered among its stockholders. These stockholders are business men and women, farmers, laborers—men and women in every walk of life.

The company they own pays over $10,000 a day in State and Federal taxes to support the government. It pays $20,000 each day in employees' wages.

It is a business of the people—just as it is the business of the people to see that the scenic beauty and the economic service of Niagara are *both* lengthened—lengthened to the utmost extent that nature and man can achieve.

A BUSINESS OF THE PEOPLE

POWER

NIAGARA SERVICE

" . . . even when Adam first came from the hand of his Maker then, as now, Niagara was roaring here."

—ABRAHAM LINCOLN

FACTS ABOUT NIAGARA FALLS

From base to crest the American Falls are 167 feet—the Horseshoe Falls 162 feet high.

The crest of the American Falls is about 1,000 feet long.

The crest of the Horseshoe Falls is about 3,000 feet long.

The Goat Island cliff is more than 1,300 feet long.

The normal flow of the river is 93,150,000 gallons per minute.

6% flows over the American Falls.

94% flows over the Horseshoe Falls.

The Niagara River falls 336 feet between Lake Erie and Lake Ontario.

From the upper rapids to the crest of the Falls, the river drops 55 feet.

From the base of the Falls to Lewiston, the river drops 94 feet.

Nearly all this drop—314 feet—takes place within about 5 miles' vicinity of Niagara Falls.

OTHER GREAT WATERFALLS OF THE WORLD

(These figures have been gleaned from the most authoritative sources available.)

AFRICA . . . . VICTORIA FALLS *(Zambesi River)*

Height from 256 feet at right bank to 343 feet in the center. Width over 5580 feet. Average flow, approximately 3,380,000 gallons per minute.

SOUTH AMERICA . . IGUASSI *(Brazil)*

215 feet high, broken into twenty or more falls. Normal flow, approximately 2,250,000 gallons per minute. The world's broadest cataract.

UNITED STATES . . YOSEMITE *(California)*

2325 feet high in three separate stages. Normal flow, about 190,500 gallons per minute. Highest falls in the world.

THE AVERAGE VOLUME OF WATER GOING OVER THESE THREE FALLS COMBINED—ABOUT 5,820,500 GALLONS PER MINUTE—IS ONLY 1-15TH THAT GOING OVER NIAGARA FALLS.

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